ENDOSCOPIC FLEXIBLE TUBE

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SPECIFICATION

1. TITLE OF THE INVENTION

Endoscopic flexible tube

2. WHAT IS CLAIMED IS;

(1) An endoscopic flexible tube whose outer coat is constructed by laminating a polymeric material in at least two layers, wherein

a common polymeric material is contained in at least the respective layers of the outer coat.

(2) An endoscopic flexible tube whose outer coat is constructed by laminating a polymeric material in at least two layers, wherein

the inner layer of the respective layers of the outer coat

is formed of a first material excellent in elasticity and repulsion, the outer layer is formed of a second material excellent in chemical resistance and abrasion resistance and different from the said material, and in at least one of both layers, the material to form the other layer is mixed.

(3) An endoscopic flexible tube as set forth in Claim 2, wherein

the first material is a polyester-based thermoplastic elastomer, the second material is a polyurethane-based thermoplastic elastomer, and the inner layer is formed by mixing the polyurethane-based thermoplastic elastomer in the polyester-based thermoplastic elastomer.

3. DETAILED DESCRIPTION OF THE INVENTION

[Field of the Invention]

The present invention relates to an endoscopic flexible tube which forms an inserting portion to be inserted into a body cavity, for example.

[Prior Arts]

As in a medical endoscope, in an endoscope whose inserting portion is inserted into the depths of a body cavity such as the duodenum, small intestine, and large intestine, it has been clinically confirmed that the degree of ease of flexure (flexibility) and resilience (elasticity and repulsion) of a

flexible tube to form the inserting portion greatly affects insertabiltiy and also affects the severity of pain inflicted on a patient.

In general, as a flexible tube, one whose front-end side is soft, whose hand side is relatively hard, and furthermore, whose whole length or at least hand side is excellent in elasticity or repulsion has a good follow-up ability with respect to an inserting operation and is considered to be excellent in insertability.

Therefore, conventionally, endoscopic flexible tubes exist, such that, as shown in Japanese Utility Model Publication No. Sho-60-38961, a part of an outer coat of a flexible tube of an inserting portion of an endoscope is provided as two layers and its operating portion side is hard, and as shown in Japanese Unexamined Patent Publication No. Sho-62-8728, different materials are laminated to improve elasticity and repulsion.

Endoscopes of these flexible tubes have elasticity and repulsion and good follow-up ability with respect to an inserting operation to be inserted into a body cavity, therefore, an improvement in insertabiltiy can be expected.

[Themes to be Solved by the Invention]

However, in the endoscopic flexible tubes of the prior arts as described above, since the outer coat of the flexible tube

is formed by laminating materials different in hardness or materials different in properties, namely, materials different in characteristics such as an elongation percentage and contraction percentage and surface wettability, distortion easily occurs between the layers due to frequent bending and repeated twisting during an inserting operation. Accordingly, problems have existed in their endurance such as sudden softening due to peeling and wrinkle generation.

The present invention has been made in view of the above-described circumstances, and an object thereof is to provide an endoscopic flexible tube which preserves follow-up ability with respect to an inserting operation and insertability and can improve endurance even against repetitive twisting.

[Means for Solving Themes and Action]

According to the present invention, in order to achieve the above-described object, Claim 1 is characterized in that, in an endoscopic flexible tube whose outer coat is constructed by laminating a polymeric material in at least two layers, a common polymeric material is contained in at least the respective layers of the outer coat, whereby adhesion is improved.

Claim 2 is characterized in that, in an endoscopic flexible

tube whose outer coat is constructed by laminating a polymeric material in at least two layers, the inner layer of the respective layers of the outer coat is formed of a first material excellent in elasticity and repulsion, the outer layer is formed of a second material excellent in chemical resistance and abrasion resistance and different from the said material, and in at least one of both layers, the material to form the other layer is mixed, whereby elasticity and repulsion are improved and adhesion is improved.

Claim 3 is characterized in that, in addition to Claim 2, the first material is a polyester-based thermoplastic elastomer, the second material is a polyurethane-based thermoplastic elastomer, and the inner layer is formed by mixing the polyurethane-based thermoplastic elastomer in the polyester-based thermoplastic elastomer.

[Preferred Embodiment]

Hereinafter, respective embodiments of the present invention will be described based on the drawings.

Fig. 1 through Fig. 3 show a first embodiment, wherein Fig. 3 shows the whole of an endoscope 1. This endoscope 1 is composed of an operating portion 2, an inserting portion 3, and a universal code 4. And, at the front end of this universal cord 4, a connector 5 is provided, and this is connected to

a light source unit (unillustrated). In the operating portion 2, an air supply/water supply/suction switching button 6, a bending operation knob 7, an ocular portion 8, and an inserting port body 9 for a treatment tool such as forceps are provided.

In addition, in the inserting portion 3, a bending tube portion 11 and a front-end component portion 3a are coupled in order at the front-end side of a flexible tube 10. And, the bending tube portion 11 can be operated to bend by a bending operation knob 7 provided on the operating portion 2. Here, inside this inserting portion 3, various built-in components such as a light guide fiber, an image guide fiber, an insertion channel, etc., (unillustrated) are inserted.

As a description of the flexible tube 10, this is constructed as shown in Fig. 1 and Fig. 2. Namely, 12 denotes a flex formed by winding a band-shaped metallic material into a spiral form. On the outer circumference of this flex 12, an outer coat 14 is coated via a braid 13. The outer coat 14 is sectioned into a front-end-side soft portion 16 and a hand-side hard portion 17 with a flexibility changing point 15 as a boundary, and the front-end-side soft portion 16 has a single-layer structure while the hand-side hard portion 17 has a two-layer structure. And, this hand-side hard portion 17 consists of an inner layer 18 and an outer layer 19, wherein the inner layer 18 is formed

to be attached so as to provide a covering on the braid 13 by injection molding, and on its outside, the outer layer 19 is formed by injection molding or the like with a fixed outside diameter while changing the thickness at the flexibility changing point 15. Accordingly, the outer cover 14 of the front-end-side soft portion 16 is formed solely by the outer layer 19, and the hand-side hard portion 17 is formed by the inner layer 18 and outer layer 19.

Herein, in the outer coat 14, the inner layer 18 is formed of a polyester-based thermoplastic elastomer a which is high in mechanical strength and excellent in elasticity and repulsion, as a first material, and the outer layer 19 is formed of a polyurethane-based thermoplastic elastomer b excellent in abrasion resistance and chemical resistance, as a second material. Furthermore, in the inner layer 18, the polyurethane-based thermoplastic elastomer b used in the outer layer 19 is mixed at a ratio of approximately 30-50%.

According to the flexible tube 10 constructed as described above, although the inner layer 18 and outer layer 19 to compose the outer coat 14 have been laminated by molding by a separate step, since the layers are excellent in adhesion between the polyester-based thermoplastic elastomer a and polyurethane-based thermoplastic elastomer b, peeling never

occurs due to repeated bending and twisting, and endurance in an inserting operation is improved. Furthermore, an effect such that a sudden change in properties at the flexibility changing point 15 is somewhat reduced whereby a smooth bending shape can be obtained is also provided.

Fig. 4 shows a second embodiment, wherein in an outer layer 19 to form the outer coat 14 of the first embodiment, in addition to the polyurethane-based thermoplastic elastomer b excellent in abrasion resistance and chemical resistance, a soft polyvinyl chloride c which has been softened by a plasticizer is mixed as a third material.

Here, in the above-described first and second embodiments, although the polyester-based thermoplastic elastomer has been used as a first material and the polyurethane based thermoplastic elastomer b has been used as a second material, the materials are not limited to those of the above-described embodiments, and the first material may be a polyolefin base, a polyamide base, or a polyvinil chloride base. In addition, the second material also may be an ethylene-vinyl acetate base or a fluorocarbon rubber base.

Furthermore, the first material and second material are not necessarily different bases, and this is, for example, a case such that the first material has an ether bond in its soft

segment portion and the second material similarly has an ester bond even if these materials are equally polyurethane bases. That is, as long as a difference in properties exists between both, the present invention can be applied.

In addition, without being limited to polyurethane bases as described above, the present invention can also be applied to a case where, even with an identical base, the first material and second material are remarkably different in hardness due to the degree of polymerization, degree of crystallinity, and addition amount of a plasticizer. (the difference in hardness is, for example, 35-55 when the first material is shoreD, and when the second material is Hs-JIS A, 60-80.)

Furthermore, in the second embodiment, what is mixed in the first material (polyester-based thermoplastic elastomer a) may not only be the second material (polyurethane-based thermoplastic elastomer b) but also both this second material and soft polyvinyl chloride of the third material. In this case, it is sufficient that the mixing ratio is, in response to the first material, approximately 30-50% of the total of the second material and third material.

Furthermore, only the third material may be mixed in the first material. In this case, the mixing ratio is similar. Namely, it is sufficient that a substance which is common to

two layers in contact exists in both layers.

Fig. 5 through Fig. 7 show a third embodiment, wherein the present invention has been applied to an electronic endoscope 20, and identical symbols are used for identical components to omit overlapping description thereof. Namely, 20a denotes a control switch portion provided on an operating portion 2, 20b denotes a connection code, and at a front-end portion of this connection code 20b, a connector 20e to be connected to a video processor 20d of a light source unit 20c is provided. Here, 20f denotes an external monitor. An outer coat 14 of a flexible tube 10 to form an inserting portion 3 of this electronic endoscope 20 is a three-layer structure of an inner layer 21, a middle layer 22, and an outer layer 23. The inner layer 21 is made of a polyester-based thermoplastic elastomer a as a first material, the middle layer 22 and outer layer 23 are made of a polyurethane-based thermoplastic elastomer b as a second material. Although the inner layer 22 and outer layer 23 are both polyurethane bases, a polyurethane-based thermoplastic elastomer d of the middle layer 22 has an ether bond in its segment portion, and the hardness thereof is high, that is, approximately 45 with shoreD, while the outer layer 23 similarly has ester bonds, and the hardness is low, that is, approximately 70 with He-JIS A. Here, as a molding method,

similar to the first and second embodiment, the layers are laminated in order.

Moreover, in the middle layer 23, the polyurethane-based thermoplastic elastomer d is added to the polyurethane-based thermoplastic elastomer b at a mixing ratio of approximately 30-50%, and all between the respective layers 22 in contact, namely, between the inner layer 21 and middle layer 22, the middle layer 22 and outer layer 23, and the outer layer 23 and inner layer 21, the common material of the polyurethane-based thermoplastic elastomer b exists.

By such a construction as in the above, properties of the outer layer 23 were provided for both the inner layer 21 and middle layer 22, therefore, although the three layers have been laminated in order by a separate step, adhesion between the respective layers was excellent, and endurance in an inserting operation was improved.

Fig. 8 shows a fourth embodiment, and identical symbols are used for identical components to omit overlapping description thereof.

Although the fourth embodiment is the same as the third embodiment in the point where an outer coat 14 of a flexible tube 10 has a three-layer structure of an inner layer 21, middle layer 22, and outer layer 23, the fourth embodiment is different

from the third embodiment in the point where the outer layer 23 is not a single substance of a polyurethane-based thermoplastic elastomer b but is mixed with a soft polyvinyl chloride c and in the point where not only the polyurethane-based thermoplastic elastomer b but also the soft polyvinyl chloride c are mixed in the middle layer 22.

Here, although in the third and forth embodiments, flexible tubes formed by mixing three types and four types of elastomers, respectively, have been shown, the quantities are not limited hereto as long as at least one common material exists between the respective layers. In addition, the materials are also not limited hereto.

Although the mixing ratios were provided as 30-50% throughout the first through fourth embodiments, the numerical value is not a rigid value, and each has an error on the order of ±10%.

In addition, although the flex 12 and braid 13 were each provided as a single layer, these may be composed of multiple layers.

[Effects of the Invention]

As has been described above, according to the present invention, in an endoscopic flexible tube whose outer coat is constructed by laminating a polymeric material in at least two

layers, since a common polymeric material is contained in at least the respective layers of the outer coat, the adhesion between the respective layers can be improved. Furthermore, the inner layer of the respective layers of the outer coat is formed of a first material excellent in elasticity and repulsion, the outer layer is formed of a second material excellent in chemical resistance and abrasion resistance and different from the said material, and in at least one of both layers, the material to form the other layer is mixed, therefore the elasticity and repulsion can be improved, whereby provided are effects such that follow-up ability with respect to an inserting operation is excellent and insertabiltiy is improved.

4. BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 through Fig. 3 show the first embodiment of the present invention, wherein Fig. 1 is a half sectional view of a flexible tube, Fig. 2 is a sectional view showing an outer coat in an enlarged manner, and Fig. 3 is a perspective view of an endoscope; Fig. 4 is a sectional view showing an outer coat of the second embodiment of the present invention in an enlarged manner; Fig. 5 through Fig. 7 show the third embodiment of the present invention, wherein Fig. 5 is a perspective view of an electronic endoscope, Fig. 6 is a half sectional view of a

flexible tube, and Fig. 7 is a sectional view showing an outer coat in an enlarged manner; and Fig. 8 is a sectional view showing an outer coat of the fourth embodiment of the present invention in an enlarged manner.

10 … flexible tube, 14 … outer coat, 18 … inner layer, 19 … outer layer.

Fig. 1

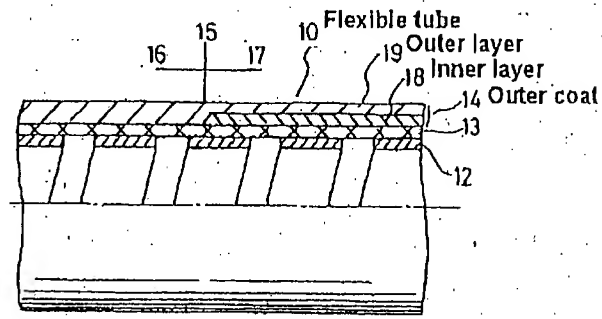

Fig.4

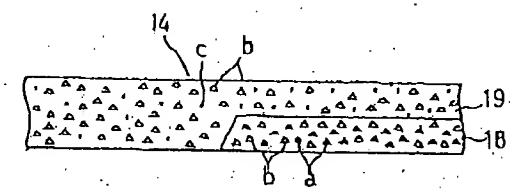

Fig.2

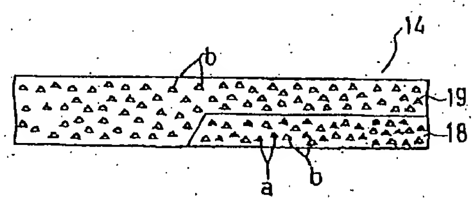

Fig.5

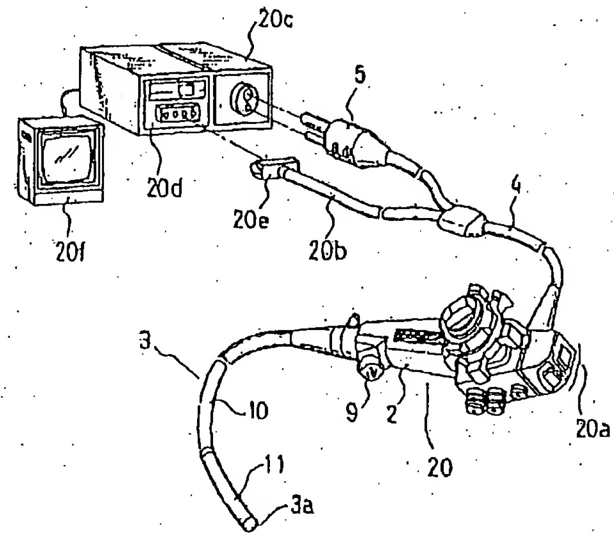

Fig.3

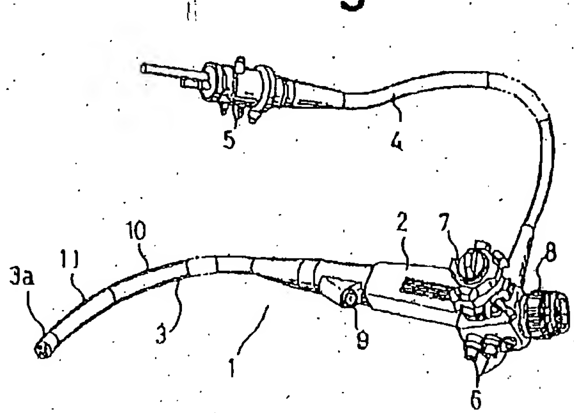

Fig.6

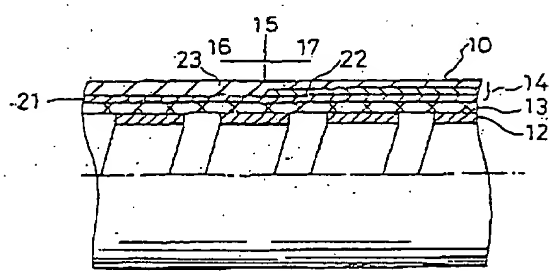

Fig.7

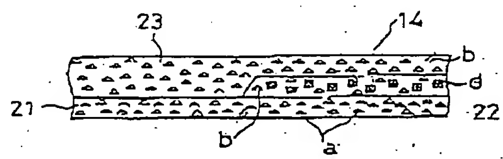

Fig.8